



Space systems — Fluid characteristics, sampling and test methods —

Part 13: Breathing air

*Systèmes spatiaux — Caractéristiques des fluides, échantillonnage et méthodes d'essai —
Partie 13: Air respirable*

ICS 49.140

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15859 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15859-13 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 15859 consists of the following parts, under the general title *Space systS*

Introduction

This International Standard specifies limits for the composition of breathing air and establishes the fluid sampling and test methods for breathing air intended for purging and pressurization of space systems. The purpose of this International Standard is to establish uniform requirements for the composition of breathing air and the sampling and test methods for breathing air used in the servicing of launch vehicles, spacecraft, and ground support equipment.

Fluid operations at a spaceport or launch site may involve a number of operators and supplier/customer interfaces, from the fluid production plant to the delivery to the launch vehicle or spacecraft. The fluid composition limits specified in this International Standard are intended to define the purity and impurity limits of the fluid for loading into the launch vehicle or spacecraft. The fluid sampling and test methods presented in this International Standard are acceptable methods for verification of the fluid composition limits.

1 Scope

This part of ISO 15859 specifies limits for the composition of breathing air and defines the fluid sampling and applicable test methods for verification of breathing air composition. This International Standard establishes acceptable composition, test, and sampling requirements. This International Standard applies to sampling and test

5 Fluid sampling

5.1 Plan

In order to ensure that the fluid composition complies with the limits specified in this International Standard, a fluid sampling plan should be established by all the involved operators, from the production to the space vehicle interface, and approved by the final user. Such plan shall specify:

5.2 Responsibility for sampling

Unless otherwise provided in an applicable technical specification, the breathing air delivered to the flight vehicle interface shall be sampled and verified by the supplier responsible for providing the breathing air to the flight vehicle. The supplier may use its own or any other resources suitable for the performance of the verification tests specified herein unless otherwise directed by the customer.

5.3 Sampling points

Unless otherwise specified, sampling shall be conducted at the fluid storage site or the flight vehicle interface.

5.4 Sampling frequency

Sampling shall be annually or in accordance with a time agreed upon by the supplier and the customer.

5.5 Sample size

The quantity in a single sample container shall be sufficient to perform the analysis for the limiting characteristics. If a single sample does not contain a sufficient quantity to perform all of the analyses for the required quality verification test, additional samples shall be taken under similar conditions.

5.6 Number of samples

6 Test methods

6.1 General

The supplier will ensure, by standard practice, the quality level of breathing air. If required, alternate test methods are described in Clause 6 of this International Standard. Other test methods not listed in this International Standard are acceptable if agreed upon between the supplier and the customer.

These tests are a single analysis or a series of analyses performed on the fluid to ensure the reliability of the storage facility to supply the required quality level. This can be verified by analysis of representative samples of the fluid from the facility at appropriate intervals as agreed upon between supplier and the customer. Tests may be performed by the supplier or by a laboratory agreed upon between the supplier and the customer.

The analytical requirements for the tests shall include the determination of all limiting characteristics of breathing air.

6.2 Parameters of analysis

The parameters for analytical techniques contained in this section are:

- a) purity shall be expressed as a percentage (%) by volume, unless otherwise specified;
- b) total hydrocarbon content “as methane” for the purpose of this International Standard is defined as the single carbon atom equivalent;
- c) calibration gas standards containing the applicable gaseous components may be required to calibrate the analytical instruments used to determine the limiting characteristic levels of fluid;
- d) if required by the customer, the accuracy of the measuring equipment used in preparing these standards shall be traceable to an established institute for standards;
- e) analytical equipment shall be operated in accordance with the manufacturer's instructions;
- f) analytical methods not listed in this International Standard are acceptable if agreed upon between the supplier and the customer.

6.3 Oxygen content

The oxygen content concentration shall be determined by one of the following procedures:

- a) by an electrochemical-type oxygen analyzer containing a solid or an aqueous electrolyte. The analyzer shall be calibrated at appropriate intervals by use of calibration gas standards or integrally in accordance with Faraday's Law. The range used should be no greater than 10 times the specified maximum oxygen content;
- b) by a heat-of-reaction-type analyzer. The analyzer shall be calibrated at appropriate intervals by the use of calibration gas standards or integrally in accordance with Faraday's Law. The range used should be not greater than 10 times the specified maximum oxygen content;
- c) by an analyzer in which oxygen reacts to form a compound which is subsequently measured. The analyzer shall be calibrated at appropriate intervals by the use of calibration standards. The range used shall be not greater than 10 times the specified maximum oxygen content;
- d) by a gas chromatograph. This method may be used not onl(he a)-1e-2.1(on)-

6.7 Carbon dioxide content

The carbon dioxide content shall be determined by one of the following procedures:

- a) by an apparatus employing a detector tube filled with a colour-reactive chemical. The degree of accuracy is dependent on the precision of the measurements and the analytical bias of the tube;
- b) by a gas cell-equipped infrared analyzer. The analyzer shall be calibrated at appropriate intervals by the use of calibration gas standards at a wavelength of approximately 4,3 micrometres. The analyzer shall be operated so its sensitivity for carbon dioxide is at least 10 % of the specified maximum carbon dioxide content;
- c) by a chromatograph method such as that described in 6.3 of this International Standard. The technique utilized shall be specific for the separation and analysis of carbon dioxide;

wavelength for C-H stretching). The analyzer shall be operated so that its sensitivity for methane is at least 10 % of the specified maximum total hydrocarbon contents;

- c) by a gas chromatograph method such as described under 6.3 of this International Standard.

6.11 Acetylene content

The acetylene content shall be determined by one of the following procedures:

- a) by a wet chemical method in which the sensitivity for acetylene is at least the specified maximum amount;
- b) by a gas cell-equipped infrared analyzer. The analyzer shall be calibrated at appropriate intervals by the use of calibration gas standards at a wavelength of approximately 13,7 microns (the characteristic absorption wavelength for acetylene). The analyzer shall be operated so that its sensitivity for acetylene is at least the specified maximum amount;
- c) by a gas chromatograph method such as described under 6.3 of this International Standard.

6.12 Aromatic, halogenated, or chlorinated hydrocarbon content

The aromatic, halogenated, or chlorinated hydrocarbon content shall be determined by one of the following procedures:

- a) by a gas chromatograph method such as described under 6.3 of this International Standard;
- b) by a mass spectrometer. The mass spectrometer shall be operated so that its sensitivity is at least 10 % of the specified maximum amount of the component;
- c) by a gas chromatograph/mass specoga.9(e)12.2()5(acec)-8.5(o)1(a)-6c0.303 6.8(o)-02-131abbb